Downloaded from orbit.dtu.dk on: May 05, 2023

DTU Library

Phase plates: new designs and concepts

Beleggia, Marco

Publication date:
2016

Document Version
Peer reviewed version

Link back to DTU Orbit

Citation (APA):
Beleggia, M. (2016). *Phase plates: new designs and concepts*. Abstract from 620th Wilhelm and Else Heraeus Seminar, Bad Honnef, Germany.

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

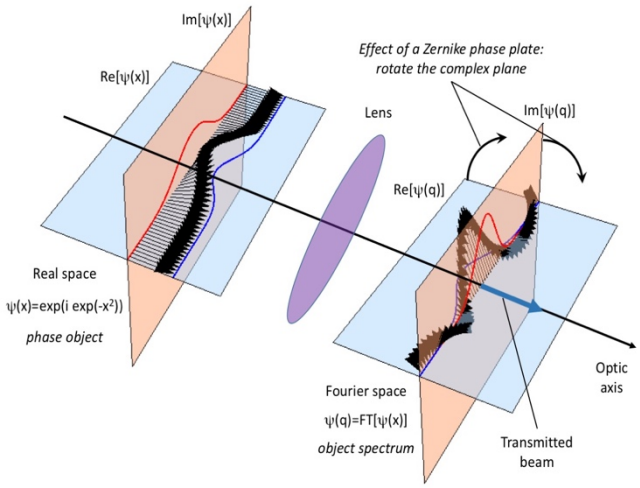
If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Phase plates: new designs and concepts

M. Beleggia[1]

[1]*Technical university of Denmark, Center for Electron Nanoscopy, DK-2800 Kgs. Lyngby, Denmark*
E-mail: mb@cen.dtu.dk

After the latest revival triggered by Danev and Nagayama [1], the field of phase plates for electron microscopy have flourished. Several new designs and concepts have been proposed to manipulate the phase of the electron wave in flexible ways [2-4]. Some designs are aimed at realizing Zernike-type phase contrast bypassing the conventional thin-film-with-a-hole setup, thinking mainly to bio-imaging applications. Others are now being explored as more general electron-optical phase-shifting elements that might prove beneficial to highlight some interesting features of samples. Achieving an ideal phase contrast where the image intensity is linearly related to the object phase shift -- $I(x)=1-2\varphi(x)$ in the case of an ideal $\pi/2$ Zernike phase plate applied to a weak phase object-- is a worthy goal as it leads to imaging dose minimization and direct interpretability. There are, however, situations where it might be more important to achieve a different type of intensity vs. phase relationship $I[\varphi(x)]$. For example, considering the archetypal phase-step samples, a pn-junction or a flux line, a differential $I[\varphi(x)]$ relationship where $I(x)=1+L\varphi'(x)$, where L is a proportionality factor with units of length, might be very useful to highlight directly the projected electric field of a pn-junction (instead of its built-in potential step) or the flux (instead of its Aharonov-Bohm shift). I will discuss in this presentation whether differential or integral $I[\varphi(x)]$ relationships, including integral transforms of the phase object, can be established by manipulation of the electron phase via non-Zernike-type phase plates.



References

[1] R. Danev and K. Nagayama, Ultramicroscopy **88**, 243 (2001)
[2] M. Malac et al., Ultramicroscopy **118**, 77 (2012)
[3] R.R. Schroeder et al., Microsc. Microanal. **13(S02)**, 127 (2007)
[4] M.K. Hari et al., J. Phys.: Conf. Ser. **241**, 012069 (2010)